L Number	Hits	Search Text	DB	Time stamp
5	24	(sulphite same cooking) same xylose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 17:47
6	12	((sulphite same cooking) same xylose) and arabinose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 17:53
7	520	magnesium adj sulphite	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 17:53
8	48	mg adj sulphite	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 17:53
9	558	(magnesium adj sulphite) (mg adj sulphite)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 17:53
10	4	((magnesium adj sulphite) (mg adj sulphite)) and xylose and liquor and arabinose and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 18:01
11	0	4075406.pn. and magnesium	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 18:02
12	0	4075406.pn. and mg	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 18:02
13	2	4075406.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 18:02
14	0	4075406.pn. and sulphite	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 18:02
-	2	5998637.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 11:23
-	2	5998607.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/24 14:25
-	1404	rhamnose and (cation near "3" exchange)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 11:54
-	400	(rhamnose and (cation near "3" exchange)) and weak	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 11:54

-	4	((rhamnose and (cation near "3" exchange)) and weak) and finex	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 12:03
-	484	(weak weakly) adj cation	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 12:04
-	0	((weak weakly) adj cation) same rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 12:04
-	10	((weak weakly) adj cation) and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 12:08
-	111	((weak weakly) adj cation) and sugar	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 15:49
-	131	sequential same continuous same bed	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 15:49
-	30	(sequential same continuous same bed) same moving	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/25 15:49
-	2	"20010009136"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 11:24
-	2	"20010009236"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 11:25
-	0	"20010009236" and (weak weakly)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 11:24
-	1	"20010009236" and (xylose rhamnose)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 11:26
-	1	"20030006191"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 11:27
-	1	"20030006191" and (xylose rhamnose weak weakly)\	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 12:50
-	1553	(monosaccharide saccharide) same chromatograph$	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 12:51

-	20	((monosaccharide saccharide) same chromatograph$) same (weak weakly)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 12:59
-	17306	hplc same ph	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 12:59
-	17306	hplc same ph	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 13:00
-	81	(hplc same ph) same weak	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 13:01
-	9	((hplc same ph) same weak) and (weak adj acid)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 14:47
-	0	hplc same (rhamanose and xylose and arabinose)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 14:48
-	0	(hplc same (rhamanose xylose arabinose)) same weak	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 14:48
-	0	(hplc same (rhamanose xylose arabinose)) same weakly	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 14:48
-	0	(hplc same (rhamanose xylose arabinose)) same weak$	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 14:48
-	151	hplc same (rhamanose xylose arabinose)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 14:50
-	44	(hplc same (rhamanose xylose arabinose)) and weak$	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 14:52
-	29	(hplc same (rhamanose xylose arabinose)) and (amberlite finex)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:06
-	1065	(weak near 6045593.PN. acid) and hplc and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:11
-	364	((weak near 6045593.PN. acid) and hplc and rhamnose) and cation	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:07

-	18	(((weak near 6045593.PN. acid) and hplc and rhamnose) and cation) and divinyl	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:08
-	28	(weak near3 acid) and hplc and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:38
-	2	5466294.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:50
-	807	chromatography and cation and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:51
-	390	(chromatography and cation and rhamnose) and weak$	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 15:52
-	43	(chromatography and cation and rhamnose) and (weak adj acid)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 16:41
-	22	hplc same (rhamnose and xylose)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 16:43
-	10	(hplc same (rhamnose and xylose)) and weak$	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/26 16:43
-	842	127/46.2.ccls. 127/46.3.ccls. 127/46.1.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:37
-	14	(127/46.2.ccls. 127/46.3.ccls. 127/46.1.ccls.) and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:37
-	3	((127/46.2.ccls. 127/46.3.ccls. 127/46.1.ccls.) and rhamnose) and (weak weakly)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:39
-	1043151	536/("124" "127" "128" 1.1)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:40
-	2	536/("124" "127" "128" 1.1).ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:40
-	1886	536/124.ccls. 536/127.ccls. 536/128.ccls. 536/1.1.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:41

-	117	(536/124.ccls. 536/127.ccls. 536/128.ccls. 536/1.1.ccls.) and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:41
-	25	((536/124.ccls. 536/127.ccls. 536/128.ccls. 536/1.1.ccls.) and rhamnose) and (weak weakly)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:44
-	1221	210/663.ccls. 210/660.ccls. 210/661.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:44
-	3	(210/663.ccls. 210/660.ccls. 210/661.ccls.) and rhamnose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/03/28 12:45
-	6	"1234404"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/05/05 14:21
-	38	"0113547"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/05/05 14:21
-	118319	ion adj exchange	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 15:53
-	25448	(ion adj exchange) same chromatography	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 15:53
-	1	(ion adj exchange) same chromatopgraphy	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 15:53
-	3389	((ion adj exchange) same chromatography) same (ion adj exchange adj resin)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 15:54
-	12	(((ion adj exchange) same chromatography) same (ion adj exchange adj resin)) same ribose	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:08
-	2	5998607.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:08
-	1	5998607.pn. and (weak$ slight$)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:20
-	2	"20020120135"	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:20
-	0	"20020120135" and aminex	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:21
-	0	"20020120135" and hpx4	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:21

-	0	"20020120135" and hpx$	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:33
-	3914	(RHAMNOSE ARABINOSE XYLOSE) and (weak weakly)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:33
-	547	(RHAMNOSE ARABINOSE XYLOSE) same (weak weakly)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:33
-	23	((RHAMNOSE ARABINOSE XYLOSE) same (weak weakly)) same (resin chromatography)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 16:34
-	15	(((RHAMNOSE ARABINOSE XYLOSE) same (weak weakly)) same (resin chromatography)) and (acid acidic) and cation	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 17:06
-	0	xylose adj side adj stream	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 17:06
-	1	xylose adj process adj stream	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 17:07
-	25	xylose and (side adj stream)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 17:07
-	2	xylose same (side adj stream)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/10/02 17:07
-	48	mg adj sulfite	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 11:48
-	48	mg adj sulphite	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 11:48
-	48	mg adj sulfite) (mg adj sulphite	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 11:48
-	8	((mg adj sulfite) (mg adj sulphite)) same liquor	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 11:51
-	792	sulphite same cooking	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 11:51
-	24	(sulphite same cooking) same xylose	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 17:47
-	0	5998607.pn. and acrylic	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 12:01

-	0	purolite same acrylic same "105"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 12:02
-	14	purolite same acrylic	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/08 12:02

catalog index

UNOsphere Ion Exchange Resins

Macro-Prep Ion Exchange Media

AG, Bio-Rex, and Chelex Analytical Grade Resins

Molecular Biology and Biotechnology Grade Resins

Reactor Grade Resins

Ion Exchange

Ion exchange chromatography separates molecules based on their net charges. Negatively or positively charged functional groups are covalently bound to a solid support matrix, yielding either a cation or anion exchanger, respectively. When a charged molecule is applied to an exchanger of opposite charge, it is adsorbed, while neutral ions or ions of the same charge are eluted in the void volume of the column. Binding of the charged molecules is reversible, and adsorbed molecules are commonly eluted with a salt or pH gradient. Ion exchange media are available in various particle sizes, ionic forms, and purity ranges.

Resin Selection Parameters

Isoelectric Point

Selection of an ion exchange support depends on the properties of the molecules to be separated. For amphoteric molecules, the isoelectric point (pI) of the molecule and its stability at various pH values determine the separation strategy. At a pH above its pI, the molecule of interest will be negatively charged and at a pH below its pI, the molecule will be positively charged. Thus, if the molecule is stable at a pH above its pI, an anion exchange support is used. Conversely, if the molecule is stable at a pH below its pI, a cation exchange support is used. The operating pH also determines the type of exchanger to use. A strong ion exchange resin maintains capacity over a wide pH range, while a weak one loses capacity when the pH moves beyond the pK_a of its functional group.

Resin Type	Cation Exchanger	Anion Exchanger
Net Charge of Molecule of Interest	+	−
Charge of Resin	−	+
Running Conditions	Run at 0.5–1.5 pH units below the pI of the molecule of interest	Run at 0.5–1.5 pH units above the pI of the molecule of interest

Separation strategy for amphoteric molecules. If the molecule is stable at a pH above its pI, an anion exchange resin is used. If the molecule is stable at a pH below its pI, a cation exchange resin is used.

Ionic Form

Many ion exchange media are available in several ionic forms and may be converted from one form to another. The ionic form of a support refers to the counterion presently adsorbed by the resin's functional group. Counterions will exhibit specific selectivities for each resin. The lower the selectivity of a counterion toward the resin, the more readily it is exchanged for another ion of like charge. Consequently, the appropriate ionic form will depend on the relative selectivity of the sample ion to be adsorbed. In general, the ionic form should have a lower selectivity for the functional group than the sample ion, so that the sample ion will displace the counterion and be adsorbed by the resin. The sample ion can then be eluted by a second counterion with a higher selectivity for the resin.

Porosity

The porosity of a support refers to the total pore volume within the matrix of the support. The greater the pore volume, the higher the porosity. A very porous support may have either many small pores or a few large pores. The exclusion limit of a support is defined by the size of the largest molecule able to enter the pores under a given set of conditions. Porous media with high exclusion limits are recommended for high molecular weight molecules such as proteins, antibodies, and other biomolecules. Low- or high-porosity media with low exclusion limits are recommended for the separation of low molecular weight molecules such as inorganic ions and organic acids. High-porosity media include Macro-Prep, Bio-Gel, and Bio-Rex 70 media. Less porous media include AG and Chelex resins.

Particle Size

Particle size is measured in micrometers, with dry mesh or wet mesh designations. The wet particle diameter will vary from resin to resin and depends on ionic form resulting from differences in the hydration of the particles. Smaller particle sizes provide higher resolution and typically require lower operational flow rates; larger particle sizes yield lower resolution but can be operated at higher flow rates.